# Hydrology

GLOBE Inquiry Model: DRAFT OUTLINE SHOWING TIME AND SEQUENCE
Total Time 9 hours (including max travel time)
6 contact hours
1.5 hours break
Up to 1 hour travel time

**Note:** *This outline provides you with a framework for agenda planning for implementation of the GLOBE inquiry-based training model. We have provided a basic content outline as well as a timeframe for completion of all activities. Currently, we have plans to develop and distribute complete lesson plan packages for each protocol area by the end of the current calendar year.*

I. **Setting the Context for Hydro TTT** (10 minutes)
   a. Material to Cover
      i. Explain workshop structure and scope
      ii. Explain the inquiry-based model
      iii. Set Expectations (Participants are expected to become GLOBE teacher trainers)
      iv. Hand out lesson plan
      v. Tell participants what they need to bring for field work
   b. Logistics/Equipment None

II. **Travel to Site** (15 min. max)

III. **Observe the Hydrology Site** (25 min.)
   a. Material to Cover
      i. What would we like to know about the properties of this water right now?
      ii. What are the main features of this site that you think are affecting the properties of this water?
      iii. What are some of the research questions we can ask about this (and other) body(ies) of water?
      iv. What would we like to investigate/measure to answer some of these questions?
   b. Equipment
      i. GLOBE Science Log
   c. Logistics
      i. Ideally this is done in the field at the Hydro Site
      ii. In case of inclement weather, can be done with maps/photos in classroom.

IV. **Characterize the Hydro Site** (25 min)
    a. Material to Cover
        i. What type of water body is this?
        ii. How large is this body of water?
        iii. Where does water enter the site?
        iv. Where does water exit the site?
        v. What surrounds this body of water? Bedrock? Development? Vegetation?
        vi. Make a Map/Sketch the Hydrology Site
        vii. Use GPS to Take Latitude, Longitude, and Elevation
        viii. Fill out Hydrology Site Definition Sheet (one per person)
    b. Equipment
        i. GLOBE Science Log
        ii. GLOBE Data Book (Hydrology Site Definition Data Sheet, GPS Data Sheet)
        iii. GPS
        iv. Compass
        v. Measuring Tape
        vi. Clinometer
        vii. Camera (optional)
    c. Logistics
        i. Ideally this is done in the field at the Hydro Site
        ii. In case of inclement weather this can be done with maps/photos in the classroom

V. **Travel Back From Site** (15 min. max)
    a. Logistics – If hydro site is too far to return, bring lunch to field site

VI. **Lunch** (60 min)

VII. **Discussion** (20 min)
    a. Material to Cover
        i. What were the research questions you asked?
        ii. What measurements/data do you need to answer your questions?
        iii. Discuss questions developed by GLOBE to guide discussion towards Hydro Protocols  Why are??????
    b. Equipment
        i. Blank Overhead/ Board / Flip Chart on which to write questions
    c. Logistics
        i. This can be done in the field using a flip chart if field site is too far to return to classroom

VIII. **Introduction to GLOBE Hydrology Measurements** (90 min.)
    a. Materials to Cover
        i. Temperature/ Thermometer calibration
        ii. Dissolved Oxygen/ DO saturation calibration

iii. Transparency
iv. pH/ pen or meter calibration
v. Alkalinity/ Standard check
vi. Conductivity/ Meter calibration
vii. Salinity/ Hydrometer technique
viii. Nitrate/ Standard check

b. Equipment
i. Basic and Advanced GLOBE Hydrology Equipment
ii. Overheads/handouts as needed to teach scientific concepts
iii. Calibration Data Sheet
iv. Distilled Water
v. GLOBE Hydrology Protocols (from Teacher's Guide)
vi. Plastic bottle for waste disposal

c. Logistics
i. Introduction and Instrument Calibration and Practice may be done in the field if site is too far to return to the classroom.
ii. If this section is to be done in the field, a table and flip chart will be helpful.
iii. Be sure to arrange for waste disposal at the site to dispose of wasted from the test kits.

IX. **Travel Time to Return to Site** (15 min. max)

X. **GLOBE Measurements in the Field** (90 min.)

a. Materials to Cover – Data Collection
i. Temperature
ii. Dissolved Oxygen
iii. Transparency
iv. pH (calibration check)
v. Alkalinity
vi. Conductivity or salinity
vii. Nitrate

b. Equipment
i. Basic and Advanced GLOBE Hydrology Equipment
ii. Data Entry Sheet (download from Data Entry page)
iii. Distilled Water
iv. GLOBE Hydrology Protocols (from Teacher's Guide)
v. Plastic bottle for waste disposal

c. Logistics
i. Have all groups repeat measurements 3 times from separate buckets
ii. Follow order of measurements from the Teacher's Guide -

XI. **Travel Back From Field** (15 min. max)

XII. **Break** (15 min.)

XIII. **Data Entry** (45 min.)

a. Materials to Cover:
   i. Logging in
   ii. Site definition
   iii. Web data entry
   iv. E-mail entry

b. Equipment
   i. Computer lab with minimum of 1 machine per 2 people
   ii. Internet connection
   iii. Video projector (if available)
   iv. Whiteboard or flip chart
   v. If no computer available, then trainer should use viewgraphs to illustrate logging in, site definition and data entry

c. Logistics
   i. Normally we will train web data entry, and mention e-mail entry. Where appropriate, we would train e-mail entry.

XIV. **Looking at Your Data** (90 min.)

a. Materials to Cover:
   i. Have participants report their data for 1 or more sites
   ii. Discuss results
      1. Are numbers reasonable?
      2. Are numbers typical? How can we find out?
      3. Compare sites if possible
      4. How useful is data from a single day? Can we answer the research questions we asked based on these data? If no, what more do we want to know?
   iii. Make a hypothesis
      1. Blank Graphs – ask participants to put data point from today on graphs, predict pattern through time, consider variability, significant differences, and range of data.
   iv. Visualizations
      1. How to find a school's data
      2. How to make a graph
      3. How to make a map
   v. Look at Similar Data
      1. Other schools in area
      2. Other schools at the same latitude
   vi. Data Mining
      1. Ask participants to think of new questions they want to explore using data from the GLOBE database. Have them write down their questions and hypotheses for the outcome.
      2. Have participants explore the GLOBE web site and look for schools that have sufficient data to answer the question you are asking. Ask them to compare two or more schools

in different/similar locations, look at change over the seasons, changes from one year to the next.

b. Equipment:
    i. Blank transparencies or flip chart
    ii. Computer lab
    iii. Graphs of GLOBE data (data exploration)
    iv. In a low-tech situation, trainers need graphs and data tables from a variety of schools (Source Books).
c. Logistics:
    i. Ideally done using GLOBE website, if not available use Source Books and/or CD.

XV. **Student Investigation** (15 min.)
a. Material to Cover:
    i. Ideas and examples of student investigations using GLOBE data
    ii. Collaborative tools on the GLOBE website:
        1. School search
        2. GLOBE Mail
        3. School-to-school collaboration
    iii. Publication tool – Student Investigations on website
b. Equipment:
    i. Student investigation project examples from website
c. Logistics:
    i. Preferable to do this in the computer lab. Have examples on overheads if computers are not available.